Session 7 Overview

Display Electronics

Chair: Hiroyuki Hirashima, *Sharp, Nara, Japan*

Associate Chair: Oh-Kyong Kwon, *Hanyang University, Seoul, Korea*

Flat-panel displays are being used in many new applications. These applications require that all sizes of displays continue to improve display quality, as well as reducing power and cost. For large displays, cost is a very important consideration because of the expanding market size and increasing competition. For small- and medium-sized displays, on the other hand, the applications require integrating more features into the displays. For example, displays may include fingerprint recognition, touch screens, ambient brightness sensing and backlight control, or other smart functions.

In this session, five papers describe work to extend the performance, add more functionality to, and reduce the power dissipation of mobile displays. Two papers describe efforts to improve the performance and reduce the cost of large displays, and one paper describes a DC-DC converter for active-matrix OLED mobile displays.

The authors of Paper 7.1 from Samsung and Hanyang U, present a design that achieves greater color depth using LTPS system-on-glass TFTs for QVGA active-matrix OLEDs. This display uses a new 8b DAC architecture that reduces the source driver size by 40% and achieves a maximum DNL of less than 1LSB.

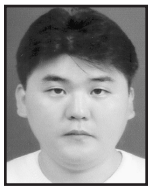
Paper 7.2, from Sharp, describes a 2.6 inch VGA active-matrix LCD that has an integrated optical input function. This function enables touch input or fingerprint recognition applications and uses a 1-transistor active-pixel sensor integrated into each display pixel to achieve an aperture ratio of 40%. The 300dpi sensor image is output with a 30Hz frame rate. In Paper 7.3, from Samsung, the authors present an integrated LVDS display interface (LDI) that includes a readout function for displays that have embedded touch sensors.

In Paper 7.4 the authors, from KAIST and JDA Technology, describe a DC-DC switching converter for active-matrix OLED mobile display panels. The dual-output step-up converter uses only one inductor.

Paper 7.5, from Hanyang U and Samsung, describes a 10b driver IC for laser projection full-HDTV applications. The driver uses a 7b resistor-string DAC and a unity-gain buffer with a 3b DAC. It has 546 output channels and a maximum settling time of 2.4μs for a 1080-pixel spatial optical modulator with 40pF capacitive loads.

The authors of Paper 7.6, from Samsung, present a one-chip 16.7M-color VGA display driver IC featuring partial graphic RAM and a 500Mb/s/ch high-speed serial interface. This driver pairs with a 1.98 inch mobile VGA amorphous-silicon TFT-LCD panel with 400 pixels per inch. The driver is fabricated in a 0.18μm triple-well CMOS process.

Paper 7.7, from KAIST, Siliconworks and LG.Philips LCD, focuses on the column driver design as a means to reduce chip size and power consumption. The authors present a column driver using push-pull buffer amplifiers operated in a transient mode.



7.1 An 8b Source Driver for 2.0 inch Full-Color Active-Matrix OLEDs Made with LTPS TFTs **1:30 PM**

Y-S. Park, Samsung SDI, Yongin City, Korea

An 8b source driver for 2.0 inch QVGA active-matrix OLEDs is fabricated using LTPS TFTs. This driver uses an 8b DAC that is separated into two parts, a 1-to-3 DEMUX, and a pre-charge method. This scheme reduces the source driver size by 40%. The maximum DNL is under 1LSB. The output voltage variation of the source driver is less than 1 LSB even though the variation of the threshold voltage is ±0.5V.

7.2 A 2.6 inch VGA LCD with an Optical Input Function Using a 1-Transistor Active-Pixel Sensor **2:00 PM**

C. Brown, Sharp Laboratories of Europe, Oxford, United Kingdom

A 2.6 inch VGA active-matrix LCD has an integrated optical input function. The optical input function may be used for touch input or fingerprint recognition applications and is achieved by integrating image sensor elements within each display pixel. By using a 1-transistor active-pixel sensor, a 30Hz, 300dpi VGA image sensor is integrated within an LCD with an aperture ratio of 40%.

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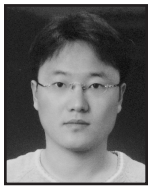
7.3 An Integrated LDI with Readout Function for Touch-Sensor-Embedded Display Panels **2:30 PM**

Y-K. Choi, Samsung Electronics, YongIn, Korea

An integrated mobile LDI with readout function is designed for touch sensor embedded display panels. This device not only drives the display panel but also senses either charge signals or current signals from the TFT sensor array with 8b resolution. The 22×1.8mm^2 chip consumes 24mW, with 3mW required for the readout function.



7.4 A Single-Inductor Step-Up DC-DC Switching Converter with Bipolar Outputs for Active-Matrix OLED Mobile Display Panels

C-S. Chae, KAIST, Daejeon, Korea **3:15 PM**

A single-chip dual-output step-up DC-DC converter is implemented for active-matrix OLED mobile display panels. The bipolar outputs are regulated independently and integrated with a boost and a charge-pump topology sharing a single inductor. The chip is 4.1mm^2 fabricated in a 0.5μm power BiCMOS process and operates at 1MHz with a maximum efficiency of 82.3% at an output power of 330mW.

7.5 A 10b Driver IC for a Spatial Optical Modulator for Full HDTV Applications **3:45 PM**

J-S. Kang, Hanyang University, Seoul, Korea

A 10b driver IC for laser projection full HDTV applications uses a 7b resistor-string DAC and a unity-gain buffer with a 3b DAC. The driver has 546 output channels, output voltage deviation of less than 1mV, a 200MHz mini-LVDS interface, and a maximum settling time of 2.4μs for a 1080pixel spatial optical modulator with 40pF capacitive loads. The IC is fabricated in a 0.35μm CMOS process and the chip area is 21.7×3.0mm^2.

7.6 A 16.7M Color VGA Display Driver IC with Partial Graphic RAM and 500Mb/s/ch Serial Interface for Mobile a-Si TFT-LCDs

K-S. Nah, Samsung Electronics, Giheung, Korea **4:15 PM**

A single-chip 16.7M color VGA display driver IC featuring partial graphic RAM and 500Mb/s/ch high-speed serial interface has been developed. It pairs with a 1.98-inch mobile VGA amorphous-silicon TFT-LCD panel with 400pixels/in. The IC has been fabricated in a 0.18μm triple-well CMOS process with high-voltage transistors and occupies 23.0×2.5mm^2. The chip has two supplies, 1.8 and 2.75V, and uses a total of 45mW.

7.7 A Column Driver with Low-Power Area-Efficient Push-Pull Buffer Amplifiers for Active-Matrix LCDs

Y-S. Son, KAIST, Daejeon, Korea **4:30 PM**

Push-pull buffer amplifiers are operated in a transient mode for column drivers suitable for vertical *N*-dot inversion of an active-matrix LCD (AMLCD) image. Each channel has a static current draw of 3.8μA and an area of 4773μm^2. The functionality of the column driver with 720 outputs is fully evaluated on the AMLCD module. The chip size of 23.2mm^2 is achieved in a 0.35μm 13.5V CMOS process.